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Tue-Af-Po2.23-12 [99]: Frequency measurement of Terahertz wave by using high magnetic field technology

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This paper introduces a novel method of frequency measurement of terahertz (THz) wave with the high magnetic field technology. According to the Zeeman Effect, the magnetic field and frequency are linear, so we can convert the measurement of frequency into the measurement of magnetic field strength by this method. Two magnet systems were used in the experiment, one of them is a pulse magnet that can generate a 30T pulsed magnetic field, and the other is a superconducting magnet that produces a steady-state magnetic field of 16T. The magnitude of the magnetic field determines the range of the frequency measurement of the method. In theory, the highest frequency can be measured at 3THz of this method. Simultaneous measurement of three frequencies of 60GHz, 170GHz, 360GHz are presented for two different configurations, using different magnet components, and measured under cryogenic conditions, respectively. It is shown that the method developed is also applicable to investigation of the mono-chromaticity of the signal. Another alternative method is also provided to achieve the purpose of eliminating the measurement error of the magnetic field, and two or three frequencies are arranged to be measured simultaneously from one or two signals, which have a known frequency. Each experimental results have a good agreement with the prediction of the theory. A discussion of both methods from the aspects of the resolution and simultaneous measurement of multi-signals are described, and finally this paper concludes with a summary that the resolution of this method is about 100MHz, and multi-frequency measurement bandwidth of 300GHz is realized.

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